**Project Title**

Fish Passage in Montana Culverts Phase II – Passage Goals

**Prepared By**

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**Introduction**

This progress report covers work completed between July 1, 2005 and September 30, 2005.   Work on the project during this period has been primarily devoted to data collection with some preliminary data analysis.

**Project Objective**

Culverts are a common and often cost effective means of providing transportation intersections with naturally occurring streams or rivers.  Fish passage and fish habitat considerations are now typical components of the planning and design of waterway crossings.  Many culverts in Montana span streams that support diverse fisheries. The health of these fisheries is an essential element of a recreational industry that draws hundreds of thousands of visitors to Montana annually.  Transportation system planners, designers and managers recognize that fish passage through Montana's culverts is a concern.  However, there is much contention concerning the impact that a culvert can have on a fishery.  Recent basin-wide studies in Montana (Phase I of this project - final report in November 2004) indicate that the tools that some planners and designers promote for forecasting fish passage concerns may be overly conservative.   This is

reflected in the diversity of fish passage goals that are being considered by state agencies in the Northwest. Some managers contend that all culverts should pass all fish at all times, whereas others suggest that this is an unrealistic criterion, particularly during high flow events. Which species, life stages, and how many individuals must have fish passage access for how long, are questions that are often brought forward during discussions on the design and retrofitting of culverts to accommodate fish passage concerns. ***The problem is that for fish species and settings in Montana, the timing and number of fish that must pass a culvert to maintain viable species diversity in the watershed is unknown.***

**Progress**

Passive integrated transponder (PIT) tags were chosen to directly measure the success or failure of individual fish in navigating the culverts in the study area. The tags were inserted into 35 fish (28 cutthroat, 2 rainbow, 4 cutthroat/rainbow hybrids and 1 mountain whitefish - mostly in the 12 to 14 inch long range) that were then released just upstream of the trap (Figure 1). Nine of the 35 fish passed through culvert 1, the first culvert upstream of the trap. The remaining 26 fish either a) returned to the Yellowstone river without spawning in Mulherin Creek, b) spawned in the approximately 1 mile-long reach between the trap and culvert 1 then returned to the Yellowstone, c) died somewhere in the system downstream of culvert 1, or d) expelled the PIT tag somewhere in the system downstream of culvert 1. A portable PIT tag antennae will be used this fall during low flow in the reach between the trap and culvert 1 to search for expelled tags.
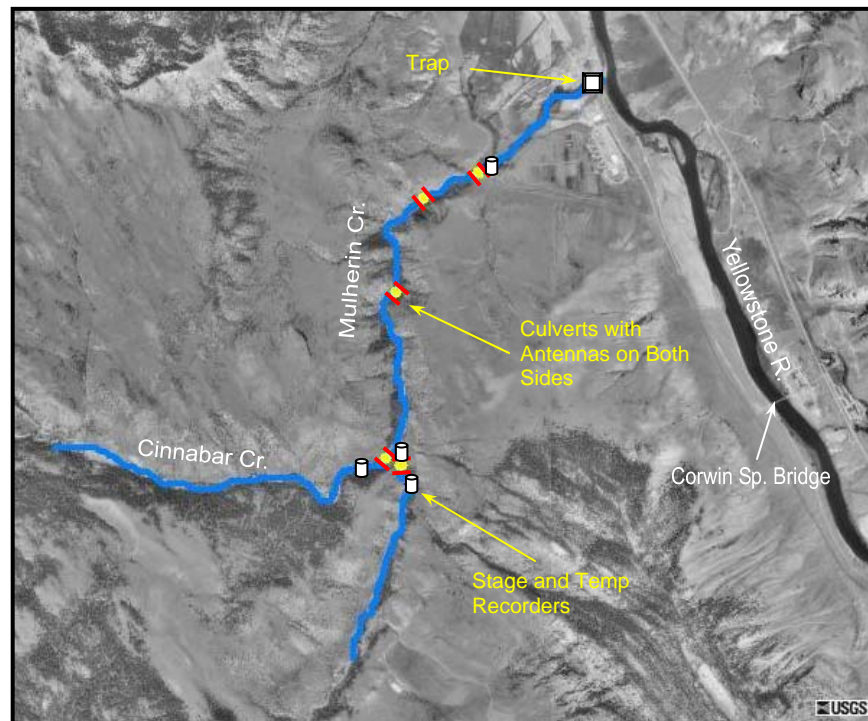


Figure 1. Location of culverts, trap, stage recorders and PIT antennas in the study area.

Figure 2.  The outlet of culvert 5.

All of the culverts except for the culvert on Cinnebar Creek (culvert 5) had at least one fish pass upstream through the culvert. Culvert 5 is a smooth barreled circular culvert with a very high velocity and a treacherous outlet setting (Figure 2). One male cutthroat made 5 attempts at culvert 5 over a 3 hour period, but did not pass through the culvert. From the PIT tag data, a time-series map of fish movement for each individual fish is being prepared.

The collection of hydraulic data to overlay on the fish passage information is nearly complete. Stage-discharge relationships have been developed for each stage recorder (example in Figure 3), with the transducer monumented for repositioning next spring. Each culvert reach has been surveyed to HEC-RAS input quality. Two-dimensional (plan and cross section) velocity profiles have been measured at each culvert.
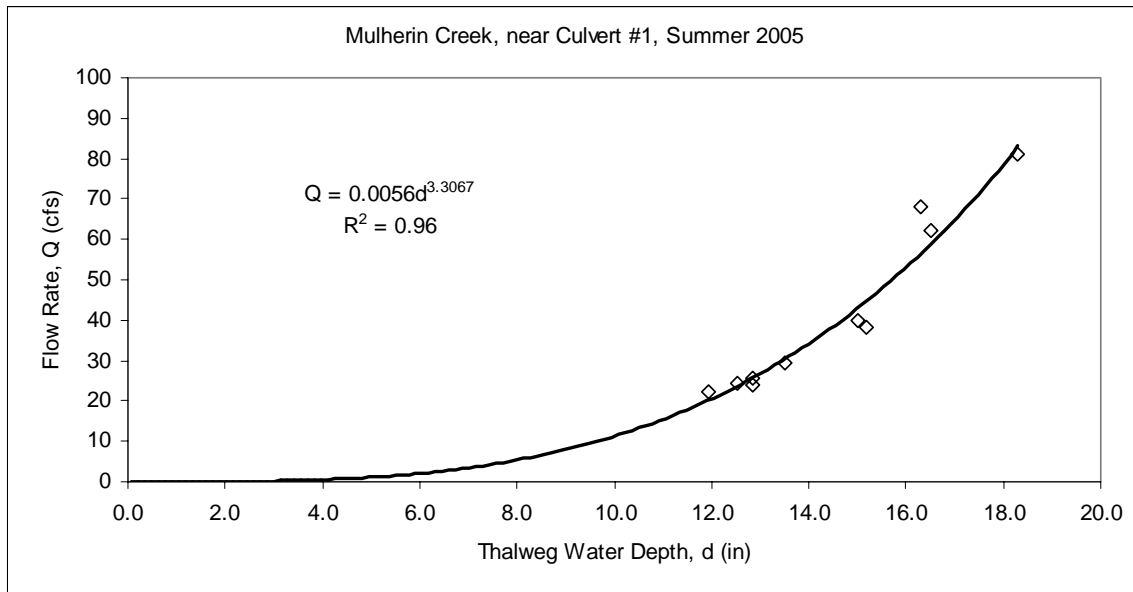


Figure 3.  An Example of a stage-discharge curve for Mulherin Creek.

**Budget**

Budget expenditures in this cycle are largely due to stipends and travel to and from the research site, with totals shown below.